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AN 1993:478050 HCAPLUS
DN 119:78050
TI **Gold**-based alloys for brazing
IN Takaku, Kyoshi; Hashimoto, Yorishige
PA Mitsubishi Materials Corp, Japan
SO Jpn. Kokai Tokkyo Koho, 5 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 05070252	A2	19930323	JP 1991-21082	19910214
PRAI	JP 1991-21082		19910214		

AB The **Au** alloys contain .gtoreq.1 element of Sb, In, Te, Pb, Al, Si, Ge, Ga, and **Sn** 0.1-50.0, and optionally .gtoreq.1 active element of **Ti**, **Zr**, **Hf**, Be, Zn, and **Nb** 0.05-10.0%. The brazes show excellent resistance to corrosion and peeling and are useful for brazing of ceramics to ceramics or metals.

PATENT ABSTRACTS OF JAPAN

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(71)Applicant : MITSUBISHI MATERIALS CORP

(72)Inventor : TAKAKU KIYOSHI
HASHIMOTO YORISHIGE

(54) ALLOY FOR BRAZING

(57)Abstract:

PURPOSE: To provide an alloy for ceramics-ceramics or ceramics-metal brazing enabling simple joining at a low temp. and capable of maintaining high reliability.

CONSTITUTION: This alloy for brazing is based on Au and contains 0.1-50.0wt.% at least one or more kinds of elements selected among Sb, In, Te, Pb, Al, Si, Ge, Ga and Sn and 0.05-10.0wt.% active element as secondary components. The active element is at least one or more kinds of elements selected among Ti, Zr, Hf, Be, Zn, Nb, etc. This alloy improves corrosion resistance and reliability, has a reduced m.p. and reduces brazing temp. The adhesion of this alloy to ceramics can be enhanced and this alloy can directly be brazed to ceramics.

LEGAL STATUS

[Date of request for examination] 23.10.1996

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration] withdrawal

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[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] The alloy for brazing and soldering which makes Au a principal component and is characterized by having included at least one or more kinds of elements chosen from nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, as an accessory constituent in 0.1 - 50.0% of the weight of the range, and containing an active element in 0.05 - 10.0% of the weight of the range further.
[Claim 2] The aforementioned active element is an alloy for brazing and soldering characterized by being at least one or more kinds of elements chosen from the element group which consists of Ti, Zr, Hf, Be, Zn, Nb, etc.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the alloy for brazing and soldering used suitable for the brazing and soldering of ceramics.
[0002]
[Description of the Prior Art] Conventionally, in electronic-parts industry, such as a semiconductor device, an integrated circuit, and capacitors (IC, LSI, etc.), brazing and soldering are widely used as a ceramic mutual one or ceramic metal mutual object for junction. For example, when carrying out the brazing and soldering of the silicon chip to a ceramic package, the method of carrying out metallizing of the metals, such as Ti, to the position which should carry out the brazing and soldering of this ceramic package, and plating nickel and Au one by one on this, and carrying out the brazing and soldering of the aforementioned silicon chip on this Au plating is common. Moreover, it is common to insert insulating ceramics between the stainless steel container of an anode plate and the stainless steel container of cathode, to carry out the brazing and soldering of these ceramics and the stainless steel container by the mass cell, and to consider as sealing structure. Moreover, as the above-mentioned alloy for brazing and soldering, silver alloys, such as an Ag-Cu system which made Ag the principal component, a Ag-Cu-Ti system, and an Ag-Sn system, are known well, for example.
[0003]
[Problem(s) to be Solved by the Invention] by the way -- although excelled in tensile strength or thermal conductivity with the aforementioned Ag system brazing-and-soldering alloy for ceramics -- the difference of the thermal expansion of ceramics and the alloy for brazing and soldering being large, and a bonding strength falling, or exfoliating **** -- etc. -- there was a problem that un-arranging arose
[0004] moreover, the ceramic metallurgy group by which this Ag is soldered in order that Ag particle may tend to start migration -- being spread -- easy -- reducing insulation or causing switch-on **** -- etc. -- there is a possibility of generating a problem and it had become the key factor to which reliability falls Moreover, although metallizing, its multilayer plating, etc. were indispensable since a common brazing-and-soldering alloy was not able to be soldered to direct ceramics, in order to prevent generating of plating ablation etc., plating conditions needed to be controlled by the case like a galvanizer on the stable certain conditions, and there was a problem that work took remarkable skill, for example by it. The above trouble becomes the big factor of the fall of the yield of a product, or a cost rise, when mass production etc. is considered.
[0005] this invention was made in view of the above-mentioned situation, and easy and offering the alloy for brazing and soldering which is made in the degree of low temperature and can moreover hold high-reliability have a ceramic mutual one or ceramic metal mutual junction.
[0006]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention adopted the following alloys for brazing and soldering. That is, it is characterized by having made Au into the principal component, having included at least one or more kinds of elements chosen from nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, as an accessory constituent in 0.1 -.50.0% of the weight of the range as an alloy for brazing and soldering according to claim 1, and containing an active element in 0.05 - 10.0% of the weight of the range further.
[0007] Moreover, as an alloy for brazing and soldering according to claim 2, the aforementioned active element is characterized by being at least one or more kinds of elements chosen from the element group which consists of Ti, Zr, Hf, Be, Zn, Nb, etc. in the alloy for brazing and soldering according to claim 1.

[0008] Here, the principal component of the aforementioned alloy was set to Au, because migration was not started and it excelled in corrosion resistance and reliability. Moreover, it considered as Au alloy containing at least one or more of nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, for the melting point of this Au alloy falling, therefore soldering temperature falling.
[0009] Moreover, an active element carries out a segregation to the junction interface of the aforementioned alloy and ceramics, it is for making a reaction layer easy to form, the adhesion of the aforementioned alloy and ceramics increases by this, and having made the addition of an active element into 0.05 - 10.0% of the weight of the range can carry out the direct brazing and soldering of the aforementioned alloy and the ceramics. Moreover, since processability falls in the range in which adhesion with ceramics is small and additions other than the above-mentioned range, for example, an addition, exceed 10.0 % of the weight by being small ineffective in less than 0.05% of the weight of the range and the melting point goes up, it is inconvenient.
[0010]
[Function] The alloy for brazing and soldering of this invention according to claim 1 makes Au a principal component, contains at least one or more kinds of elements chosen from nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, as an accessory constituent in 0.1 - 50.0% of the weight of the range, and contains an active element in 0.05 - 10.0% of the weight of the range further.
[0011] Moreover, as for the alloy for brazing and soldering according to claim 2, the aforementioned active element consists of at least one or more kinds of elements chosen from the element group which consists of Ti, Zr, Hf, Be, Zn, Nb, etc. in the alloy for brazing and soldering according to claim 1.
[0012] Here, by setting the principal component of the aforementioned alloy to Au, migration is not started and corrosion resistance and reliability improve. Moreover, by considering as Au alloy containing at least one or more of nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, the melting point of this Au alloy falls and soldering temperature falls.
[0013] Moreover, by making the addition of an active element into 0.05 - 10.0% of the weight of the range, an active element is unevenly distributed in the junction interface of the aforementioned alloy and ceramics, a reaction layer is formed, the adhesion of the aforementioned alloy and ceramics increases by this, and the direct brazing and soldering of the aforementioned alloy and the ceramics are carried out. The front face of a joint with ceramics is corroded by the high affinity of an active element, and the aforementioned reaction layer is formed because the compound of the active element of a large bond strength carries out a segregation to a junction interface by this. the case where an active element is set to Ti -- ceramics -- an oxide -- TiO2 -- moreover -- a nitride -- Ti3N4 -- moreover, in carbide, TiC carries out a segregation to a junction interface
[0014]
[Example] Hereafter, the alloy for brazing and soldering of one example of this invention is explained. Table 1 shows composition of the alloy for brazing and soldering of this invention, and Table 2 shows the property of the alloy for brazing and soldering of Table 1, respectively.

[Table 1]

No.	組成 (重量%)								
	Au	Si	Ge	Ga	Sn	Ii	Ti	Zr	Hf
1	96.36	3.14					0.5		
2	87.2		12.0				0.8		
3	96	2.0					2.0		
4	79				20			1.0	
5	80					18			2.0
6	83			16			1.0		

[Table 2]

No.	融点 (°C)	ろう付け温度 (°C)	耐蝕性	剥離テスト (接合性)
1	370	400	○	○
2	356	390	○	○
3	370	400	○	○
4	280	320	○	○
5	451	490	○	○
6	341	370	○	○

The above-mentioned front shell and the alloy for brazing and soldering of this invention have the melting point and low soldering temperature, and it turns out that it is the alloy excellent in corrosion resistance, junction nature, etc.

[0015] Next, the example which soldered ceramics using the alloy for brazing and soldering of this invention mentioned above is explained.

[0016] (The 1st example) The insulating ceramics 4 with which the quality of the material consists of aluminum 2O3 were inserted like drawing 1 between the stainless steel container 2 of the anode plate of the mass cell 1, and the stainless steel container 3 of cathode, and it considered as the structure where carried out the brazing and soldering of these ceramics 4 and the stainless steel containers 2 and 3 with the alloy 5 for brazing and soldering, and the electrolytic solution 6 was sealed.

[0017] Comparison examination was carried out here with example [using Ag system alloy] 1 of comparison, example [using aluminum system alloy] 2 of comparison, and example of the comparison using Au system alloy which does not contain active element 3 each, using the sample of No.2 as an alloy for brazing and soldering of an example 1. Table 3 shows these evaluation results.

[Table 3]

	ロウ付温度	耐蝕性	セラミックのヒートクラック	気密性	備考
実施例1	250～500°C	○	○	○	密着性良好
比較例1	700～850°C	×	×	○	
比較例2	600°C	×	○	○	
比較例3	250～500°C	○	—	×	ろう付けできず

the Ming kana from Table 3 -- with the alloy for brazing and soldering of this example (No.2), the brazing and soldering which were excellent in adhesion were made like, without the electrolytic solution's having not eroded and ceramics breaking by the heat shock at the time of soldering.

[0018] (The 2nd example) Like drawing 2 , the specified quantity application of the alloy 13 for brazing and soldering of this invention (No.1) was carried out in the position which the ceramic package 12 of an integrated circuit (IC) 11 base 12a Curses and which should touch, the silicon chip 14 was laid on this alloy 13 for brazing and soldering, and it soldered at 400 degrees C. With the alloy for brazing and soldering of this example (No.1), generating of the crack by the heat shock at the time of soldering was not accepted, but, as for the brazing and soldering which were excellent in adhesion, the both sides of a ceramic package 12 and a silicon chip 14 were able to do.

[0019] (The 3rd example) The window frame-like preforming material of the alloy 16 for brazing and soldering of this invention (No.4) was inserted in the position which should carry out the brazing and soldering of the lid 15 which consists of a Fe-nickel alloy of the upper surface of the ceramic package 12 of an integrated circuit (IC) 11 etc. like drawing 2 , and it soldered at 320 degrees C. Although brazing and soldering were carried out

with the alloy for brazing and soldering of this example (No.4), without [without it carries out metallizing to the plane of composition cursed ceramic-package 12, and] carrying out nickel plating of the plane of composition cursed lid 15, generating of the crack by the heat shock at the time of soldering was not accepted in a ceramic package 12, but airtight outstanding brazing and soldering were made.

[0020] Since the principal component of the aforementioned alloy was set to Au according to the alloy for brazing and soldering of the above-mentioned example as explained above, migration cannot be started and corrosion resistance and reliability can be raised. Moreover, since it considered as Au alloy including at least one or more kinds in the element group of Si, germanium, Ga, Sn, and In, the melting point of this Au alloy can be reduced and soldering temperature can be reduced.

[0021] Moreover, since the addition of an active element (Ti, Zr, Hf) was made into 0.05 - 10.0% of the weight of the range, an active element can be unevenly distributed in the junction interface of the aforementioned alloy and ceramics, a reaction layer can be formed, the adhesion of the aforementioned alloy and ceramics can be raised by this, and the direct brazing and soldering of the aforementioned alloy and the ceramics can be carried out. When at least one kind of Ti, Zr, and Hf is added especially, a reaction layer can be formed because the front face of a joint with ceramics is corroded by the very high affinity of an active element and the compound of the active element of a large bond strength carries out the segregation of the reaction layer to a junction interface by this.

[0022] Thus, it becomes possible that a ceramic mutual one or ceramic metal mutual junction is easy and to offer the alloy for brazing and soldering which is made in the degree of low temperature and can moreover hold high-reliability.

[0023]

[Effect of the Invention] Since the principal component of the aforementioned alloy was set to Au according to the alloy for brazing and soldering of this invention according to claim 1 as explained above, migration cannot be started and corrosion resistance and reliability can be raised. Moreover, since at least one or more kinds of elements chosen from nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, are included in 0.1 - 50.0% of the weight of the range as an accessory constituent of the aforementioned alloy, the melting point of the aforementioned alloy can be reduced and soldering temperature can be reduced.

[0024] Moreover, since the addition of an active element was made into 0.05 - 10.0% of the weight of the range, an active element can be unevenly distributed in the junction interface of the aforementioned alloy and ceramics, a reaction layer can be formed, the adhesion of the aforementioned alloy and ceramics can be raised by this, and the direct brazing and soldering of the aforementioned alloy and the ceramics can be carried out.

[0025] According to the alloy for brazing and soldering according to claim 2, it sets into the alloy for brazing and soldering according to claim 1. moreover, the aforementioned active element Since it is at least one or more kinds of elements chosen from the element group which consists of Ti, Zr, Hf, Be, Zn, Nb, etc. A reaction layer including at least one or more kinds of active metals, such as Ti, Zr, Hf, Be, Zn, and Nb The front face of a joint with ceramics is corroded by the very high affinity of an active element, and a reaction layer can be formed because the compound of the active element of a large bond strength carries out a segregation to a junction interface by this. Therefore, the adhesion of the aforementioned alloy and ceramics can be raised further and the direct brazing and soldering of the aforementioned alloy and the ceramics can be carried out more powerfully.

[0026] Thus, it becomes possible that a ceramic mutual one or ceramic metal mutual junction is easy and to offer the alloy for brazing and soldering which is made in the degree of low temperature and can moreover hold high-reliability.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] this invention relates to the alloy for brazing and soldering used suitable for the brazing and soldering of ceramics.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Conventionally, in electronic-parts industry, such as a semiconductor device, an integrated circuit, and capacitors (IC, LSI, etc.), brazing and soldering are widely used as a ceramic mutual one or ceramic metal mutual object for junction. For example, when carrying out the brazing and soldering of the silicon chip to a ceramic package, the method of carrying out metallizing of the metals, such as Ti, to the position which should carry out the brazing and soldering of this ceramic package, and plating nickel and Au one by one on this, and carrying out the brazing and soldering of the aforementioned silicon chip on this Au plating is common. Moreover, it is common to insert insulating ceramics between the stainless steel container of an anode plate and the stainless steel container of cathode, to carry out the brazing and soldering of these ceramics and the stainless steel container by the mass cell, and to consider as sealing structure. Moreover, as the above-mentioned alloy for brazing and soldering, silver alloys, such as an Ag-Cu system which made Ag the principal component, a Ag-Cu-Ti system, and an Ag-Sn system, are known well, for example.

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EFFECT OF THE INVENTION

[Effect of the Invention] Since the principal component of the aforementioned alloy was set to Au according to the alloy for brazing and soldering of this invention according to claim 1 as explained above, migration cannot be started and corrosion resistance and reliability can be raised. Moreover, since at least one or more kinds of elements chosen from nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, are included in 0.1 - 50.0% of the weight of the range as an accessory constituent of the aforementioned alloy, the melting point of the aforementioned alloy can be reduced and soldering temperature can be reduced.
[0024] Moreover, since the addition of an active element was made into 0.05 - 10.0% of the weight of the range, an active element can be unevenly distributed in the junction interface of the aforementioned alloy and ceramics, a reaction layer can be formed, the adhesion of the aforementioned alloy and ceramics can be raised by this, and the direct brazing and soldering of the aforementioned alloy and the ceramics can be carried out.
[0025] Moreover, according to the alloy for brazing and soldering according to claim 2, it sets into the alloy for brazing and soldering according to claim 1, and is the aforementioned active element. Since it is at least one or more kinds of elements chosen from the element group which consists of Ti, Zr, Hf, Be, Zn, Nb, etc. A reaction layer including at least one or more kinds of active metals, such as Ti, Zr, Hf, Be, Zn, and Nb The front face of a joint with ceramics is corroded by the very high affinity of an active element, and a reaction layer can be formed because the compound of the active element of a large bond strength carries out a segregation to a junction interface by this. Therefore, the adhesion of the aforementioned alloy and ceramics can be raised further and the direct brazing and soldering of the aforementioned alloy and the ceramics can be carried out more powerfully.
[0026] Thus, it becomes possible that a ceramic mutual one or ceramic metal mutual junction is easy and to offer the alloy for brazing and soldering which is made in the degree of low temperature and can moreover hold high-reliability.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] by the way -- although excelled in tensile strength or thermal conductivity with the aforementioned Ag system brazing-and-soldering alloy for ceramics -- the difference of the thermal expansion of ceramics and the alloy for brazing and soldering being large, and a bonding strength falling, or exfoliating **** -- etc. -- there was a problem that un-arranging arose
[0004] moreover, the ceramic metallurgy group by which this Ag is soldered in order that Ag particle may tend to start migration -- being spread -- easy -- reducing insulation or causing switch-on **** -- etc. -- there is a possibility of generating a problem and it had become the key factor to which reliability falls Moreover, although metallizing, its multilayer plating, etc. were indispensable since a common brazing-and-soldering alloy was not able to be soldered to direct ceramics, in order to prevent generating of plating exfoliation etc., plating conditions needed to be controlled by the case like a galvanizer on the stable certain conditions, and there was a problem that work took remarkable skill, for example by it. The above trouble becomes the big factor of the fall of the yield of a product, or a cost rise, when mass production etc. is considered.
[0005] this invention was made in view of the above-mentioned situation, and easy and offering the alloy for brazing and soldering which is made in the degree of low temperature and can moreover hold high-reliability have a ceramic mutual one or ceramic metal mutual junction.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention adopted the following alloys for brazing and soldering. That is, it is characterized by having made Au into the principal component. having included at least one or more kinds of elements chosen from nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, as an accessory constituent in 0.1 - 50.0% of the weight of the range as an alloy for brazing and soldering according to claim 1, and containing an active element in 0.05 - 10.0% of the weight of the range further.

[0007] Moreover, as an alloy for brazing and soldering according to claim 2, the aforementioned active element is characterized by being at least one or more kinds of elements chosen from the element group which consists of Ti, Zr, Hf, Be, Zn, Nb, etc. in the alloy for brazing and soldering according to claim 1.

[0008] Here, the principal component of the aforementioned alloy was set to Au, because migration was not started and it excelled in corrosion resistance and reliability. Moreover, it considered as Au alloy containing at least one or more of nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, for the melting point of this Au alloy falling, therefore soldering temperature falling.

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OPERATION

[Function] The alloy for brazing and soldering of this invention according to claim 1 makes Au a principal component, contains at least one or more kinds of elements chosen from nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, as an accessory constituent in 0.1 - 50.0% of the weight of the range, and contains an active element in 0.05 - 10.0% of the weight of the range further.
[0011] Moreover, as for the alloy for brazing and soldering according to claim 2, the aforementioned active element consists of at least one or more kinds of elements chosen from the element group which consists of Ti, Zr, Hf, Be, Zn, Nb, etc. in the alloy for brazing and soldering according to claim 1.
[0012] Here, by setting the principal component of the aforementioned alloy to Au, migration is not started and corrosion resistance and reliability improve. Moreover, by considering as Au alloy containing at least one or more of nine kinds of element groups, Sb, In, Te, Pb, aluminum, Si, germanium, Ga, and Sn, the melting point of this Au alloy falls and soldering temperature falls.
[0013] Moreover, by making the addition of an active element into 0.05 - 10.0% of the weight of the range, an active element is unevenly distributed in the junction interface of the aforementioned alloy and ceramics, a reaction layer is formed, the adhesion of the aforementioned alloy and ceramics increases by this, and the direct brazing and soldering of the aforementioned alloy and the ceramics are carried out. The front face of a joint with ceramics is corroded by the high affinity of an active element, and the aforementioned reaction layer is formed because the compound of the active element of a large bond strength carries out a segregation to a junction interface by this. the case where an active element is set to Ti -- ceramics -- an oxide -- TiO2 -- moreover -- a nitride -- Ti3N4 -- moreover, in carbide, TiC carries out a segregation to a junction interface

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[Translation done.]

EXAMPLE

[Example] Hereafter, the alloy for brazing and soldering of one example of this invention is explained. Table 1 shows composition of the alloy for brazing and soldering of this invention, and Table 2 shows the property of the alloy for brazing and soldering of Table 1, respectively.

[Table 1]

No.	組成 (重量%)								
	Au	Si	Ge	Ga	Sn	Ii	Ti	Zr	Hf
1	96.36	3.14					0.5		
2	87.2		12.0				0.8		
3	96	2.0					2.0		
4	79				20			1.0	
5	80					18			2.0
6	83			16			1.0		

[Table 2]

No.	融点 (°C)	ろう付け温度 (°C)	耐蝕性	剥離テスト (接合性)
1	370	400	○	○
2	356	390	○	○
3	370	400	○	○
4	280	320	○	○
5	451	490	○	○
6	341	370	○	○

The above-mentioned front shell and the alloy for brazing and soldering of this invention have the melting point and low soldering temperature, and it turns out that it is the alloy excellent in corrosion resistance, junction nature, etc.

[0015] Next, the example which soldered ceramics using the alloy for brazing and soldering of this invention mentioned above is explained.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline cross section of the cell of the large capacity attached and carried out which will shine using the alloy for brazing and soldering of this invention.
[Drawing 2] It is the outline cross section of the integrated circuit (IC) which will shine using the alloy for brazing and soldering of this invention and which was attached and carried out.
[Description of Notations]
1 Cell
2 Three Stainless steel container
4 Ceramics
5 Alloy for Brazing and Soldering
6 Electrolytic Solution
11 Integrated Circuit (IC)
12 Ceramic Package
13 Alloy for Brazing and Soldering
14 Silicon Chip
15.Lid
16 Alloy for Brazing and Soldering

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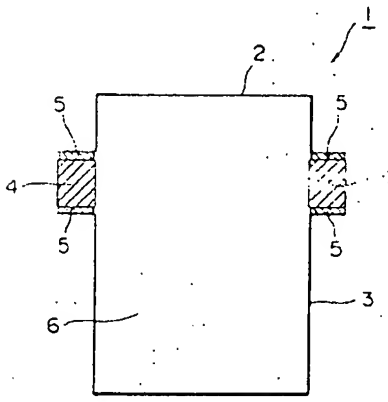
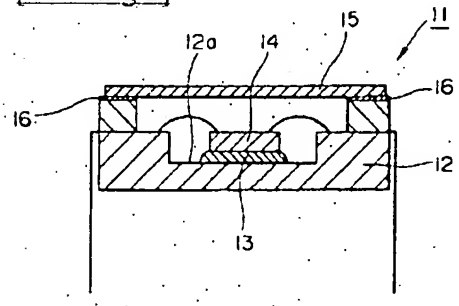
DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]